

spectra of gases which give, therefore, bright lines on the negative; that is, they do not change the silver salt. This discovery, I think, is of great importance, for it shows that there are rates of vibration to which the photographic plate does not respond. It is imperfect in science as well as in art, and does not give a complete history of the stars, the temperatures of which are probably much higher even than those which I have reached. These dark lines are not due to what is called solarization or to absorption. The solar spectrum is thus probably far more complex even than we have supposed. This new field of what may be called destructive dissociation of gases in which I am working, promises to lead to many important results in the new science of electrochemistry.

[Prof. Trowbridge projected some lantern slides of the spectra of gases obtained with the discharges from the large storage battery, which showed the universal spectrum of water vapor and the remarkable dark lines of which he had spoken.—THE SECRETARIES.]

THE INFLUENCE OF ALCOHOLIC INTOXICATION UPON CERTAIN FACTORS CONCERNED IN THE PHENOMENA OF HÆMOLYSIS AND BACTERIOLYSIS.

A PRELIMINARY NOTE.

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In 1896 one of us (A. C. A.) published the results of an investigation upon the influence of alcoholic intoxication on resistance to infection.¹ In that paper attention was directed to the fact that the susceptibility of rabbits to certain types of infection was markedly increased through the influence of prolonged alcoholic intoxication. These results have been fully confirmed by others.²

At the time the results were published no fully satisfactory explanation of the mechanism of this phenomenon was available, though several suggestions were offered, viz., the reduced resistance may be referable to the local action of the alcohol upon the gastric mu-

¹ See *Journal of Exp. Med.*, 1896, Vol. i.

² See Laitinen, *Acta Societatis Scientiarum Fennicæ*, Tom. xxix, No. 7, 1900; also *Zeit. f. Hyg. u. Infektionskrankheiten*, 1900, Band 34, S. 206.

cous membrane, thereby impairing the nutrition of the animal to such an extent as to create conditions analogous to starvation, a state in which susceptibility is also seen to be increased; or, to a diminution in the alkalinity of the blood through the acids resulting from the oxidation of the alcohol—such reduction in alkalinity, though slight, has since been shown by Laitinen to occur; or, to the remote action of the alcohol on the nervous system. The value of neither of these hypotheses was, however, susceptible of ready determination, so that the matter rested there for a time.

During the past three or four years a series of brilliant investigations, especially by Bordet, Buchner, Metschnikoff, Ehrlich and Morgenroth and their associates, upon certain physiological phenomena peculiar to the blood and other fluids of the body, have acquainted us with many hitherto obscure and unknown phases of the subject. One of these newly discovered blood reactions seemed especially adapted to the solution, in part at least, of our problem.

It has been demonstrated by the investigators named that an animal may be rendered immune from the intoxicating effects of the blood of another species; that when such immunity is established the blood serum of the immune animal rapidly and completely dissolves the erythrocytes of the alien blood, even when mixed with them in a test tube (hæmolysis); that if such immune serum be heated for thirty minutes to 55° – 56° C. it loses its hæmolytic power; and that the power of hæmolysis is at once restored to the heated serum by the addition of a few drops of serum from a normal mammal. These reactions are believed to occur through the agency of two bodies present in the serum—the one a body resistant to low degrees of heat, a “receptor” or “intermediary” body;¹ the other a complementary something, perhaps a ferment, common to all mammalian serums, that is destroyed by heat. The “receptor” or “intermediary body” is conceived to have the property of fixing the invading cells (in this case the blood cells of another species) on the one hand, and the complementary, ferment-like body on the other, bringing and holding them together in a way most favorable to the destructive action of the ferment upon the invading cell. The destruction of bacteria by the fluids of the body is thought to take place in an analogous manner, it being assumed that in the blood are “receptors” having the property of

¹ Synonyms—Anticörps hémolytique, Substance preventive, Immune Körper, Amboceptor, Philocytase, Desmon, Copula, Substance sensibilisatrice, Fixateur.

fixing, on the one hand, bacteria, and on the other a "complement" having the power to destroy such bacteria, the relation of receptor to bacteria and to complement being in both cases specific.

The question under consideration by us was:

"Will the sera of animals under the influence of alcohol for varying lengths of time, but otherwise normal, restore to a heated immune serum its hæmolytic activity in the same way as is done by the normal sera of non-alcoholized animals?"

If it will, then the action of alcohol upon the animal organism is plainly not evidenced through a reduction in the amount of the complementary substance so necessary to normal resistance and to immunity. If it will not, then the reverse must be the case.

Should the serum of animals under the influence of alcohol prove to be poorer in hæmolytic "complement" than that of animals not so treated, then there is some justification for the belief that the reduction of resistance to bacterial infections, noted in our work of 1896, may be due to the suppression (in part or in whole) of a "complementary" "proteolytic ferment" (?) that constitutes one of the natural defenses of the body against the invasion of infective bacteria. Without discussing our results in detail, it suffices to say that we found in a number of animals daily intoxicated for a period of about three weeks, the amount of "complement" in their sera to be from fifteen to twenty-five per cent. less than that of normal sera, as determined by the power to "reactivate" a heated immune serum—*i. e.*, to restore to it its hæmolytic properties, a result that we regard as of fundamental importance in explaining (in part at least) the results of investigations made in 1896.

In the course of this work a number of important collateral questions arose, the most significant of which being as to whether the effect noted by us could be interpreted as a general reduction of all complementary substances¹ in the blood, or as only a reduction of a single complement specifically concerned in the phenomenon of hæmolysis; but as their solution is as yet only in the initial stages, it is scarcely necessary to introduce them at this time.

¹ It is believed by Ehrlich and Morgenroth and their associates that the blood contains a multiplicity of complementary elements, each one of which is specifically related to particular receptors and to particular irritants and intoxicants; while Buchner, Bordet, Metschnikoff and their adherents contend that the complement, designated by Buchner and Bordet as "alexine" and by Metschnikoff as "cytase," is a single substance possessed of heterogeneous affinities.